BASELINE SOIL AND GROUNDWATER QUALITY ASSESSMENT
SEATTLE CITY LIGHT LONG-TERM LEASE OPTION
SEATTLE, WASHINGTON

Prepared for

Boeing Environmental Affairs
Seattle, Washington

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1.0 INTRODUCTION

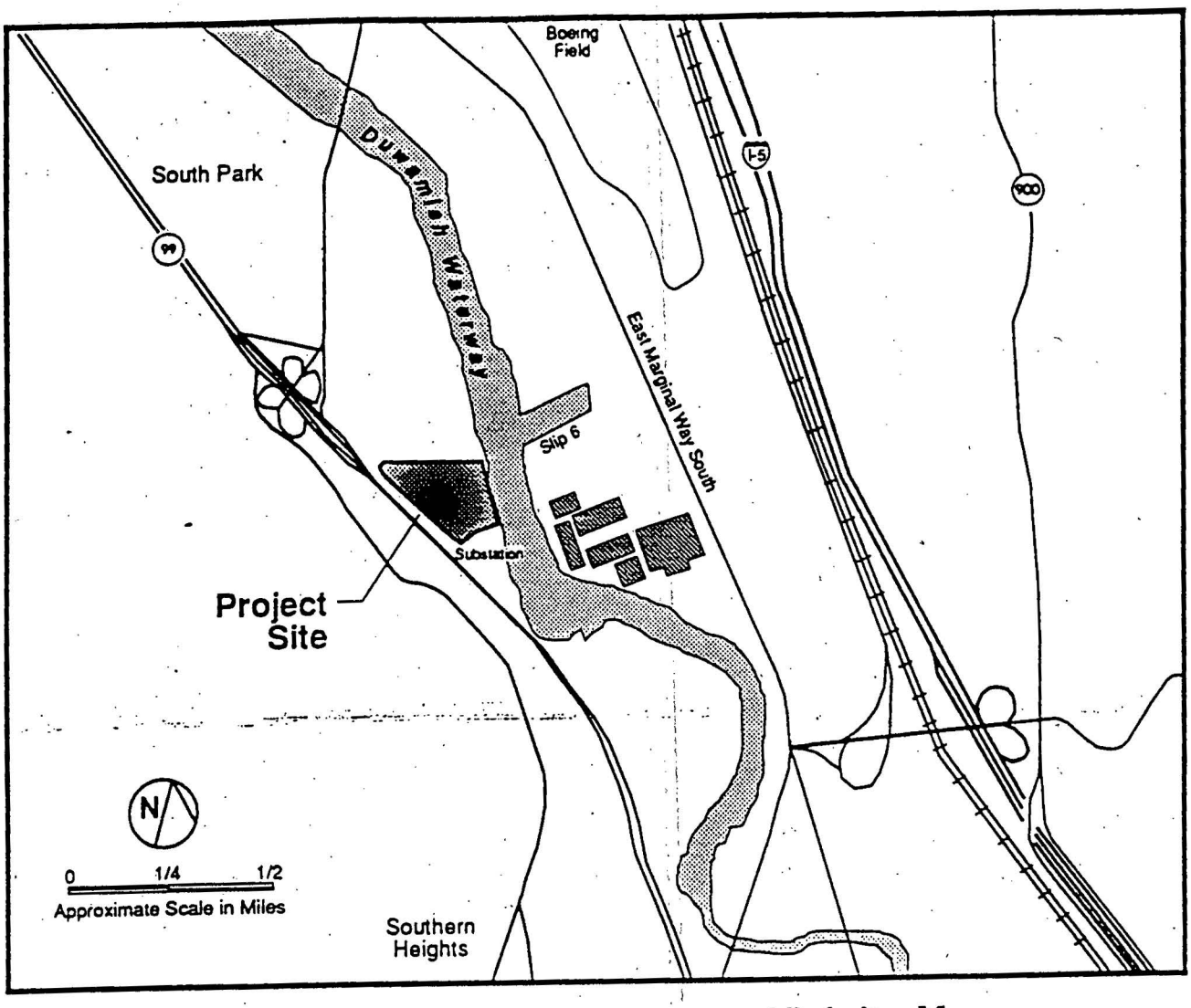
This report contains Roy F. Weston Inc.'s (WESTON's) findings from the baseline soil and groundwater quality assessment for the Seattle City Light (SCL) long-term lease option. The work was accomplished in accordance with our proposal dated 10 April 1990, and as modified by The Boeing Company (Boeing) and WESTON during the course of the field work.

1.1 Background

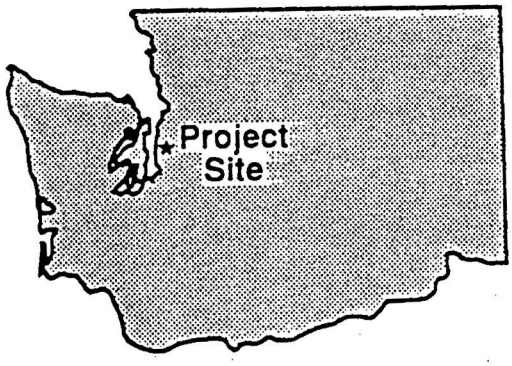
Boeing is evaluating an option to enter into a 50-year lease agreement with SCL on property adjoining SCL's Duwamish substation at 10000 West Marginal Place South. The undeveloped property is located on the Duwamish Waterway in Seattle, Washington (Figure 1).

We understand that the property was undeveloped in the 1930s (as indicated by aerial photographs) and that Corps of Engineers' records indicate that dredged sediment from the Duwamish Waterway was placed across the property in 1968. We also understand that dredged sediment was placed in the east-central portion of the property in 1985 from dredging of the Duwamish Yacht Club marina located north of the property.

Analysis of soil samples collected from the 1968 fill on SCL property immediately north of the lease option indicates that polychlorinated biphenyls (PCBs) and pentachlorophenols (PCPs) were undetected (i.e., below 0.01 ppm), that the samples were not state dangerous waste for halogenated hydrocarbons or poly-cyclic aromatic hydrocarbons (PAHs), and that they were not EP toxic for metals (Raven Systems & Research, Inc., 30 December 1987). Analysis of a composite soil sample from the 1985 dredge fill on the lease option revealed concentrations of 0.05 mg/kg PCBs and less than 10 mg/kg halogenated hydrocarbons. The 1985 dredge fill sample also contained less than state-regulated concentrations of PAHs and was not EP toxic for metals (Laucks Testing Laboratory, Laboratory No. 90364, 18 July 1985).



Vicinity Map



Washington State

Project Site Locator Map

Figure 1

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1.2 Purpose and Objectives

The purpose of this work is to support Boeing's due diligence effort in assessing the property and to provide a baseline for comparing and assessing soil and groundwater quality conditions at the property after lease termination. The purpose of the sampling and analytical program strategy was to minimize the overall number of media samples, while maximizing the likelihood of detection of organic compounds or metals in each media.

The soil and groundwater quality assessment was designed to achieve the following objectives:

- Assess soil quality along the fence line of the substation for PCBs and chlorinated herbicides based on their potential use at the substation and potential migration onto the lease property.

- Assess soil quality in the 1968 dredge fill for arsenic, barium, cadmium, chromium, lead, mercury, selenium, sliver, copper, tin, and PAHs. These parameters were selected based on the prevalent contaminants identified elsewhere in the Duwamish Waterway area. Copper and tin were included because of their potential adverse affects on aquatic life.

- Assess soil quality in the 1985 dredge fill for the ten metals, semivolatile organic compounds, and PCBs. The full semivolatile scan (i.e., base/neutral/acid extractable fractions) was recommended based on typical practices/activities associated with marinas.

- Assess groundwater quality beneath the property for volatile organic compounds (VOCs) and conventional water quality parameters. Groundwater was analyzed for VOCs to assess potential releases of fuels or solvents from the substation or other off-site sources and/or from the dredge fill. Conventional parameters were sampled to assess baseline conditions and the influence, if any, of seawater from the waterway.

1.3 Summary of Findings

Seven soil borings (6 to 20 feet deep) were drilled and sampled on the property on 17 and 18 April 1990. Composite soil samples from each boring were analyzed for PAHs and metals. Samples from the 1985 dredge fill area were additionally analyzed for PCBs. Low levels of a few PAHs and several metals were detected in the soil samples at concentrations below the most stringent applicable regulations (i.e., draft Washington Model Toxics Control Act Cleanup Regulations). PCBs were not detected in the 1985 dredge fill samples.

Three of the borings were completed as monitoring wells. The wells were sampled for groundwater and analyzed for VOCs and selected conventional groundwater quality parameters. Acetone, present at a very low concentration in one well, was the only VOC detected in the samples.

Five composite surface soil samples were collected along the substation fence line and analyzed for PCBs and chlorinated herbicides. Neither PCBs nor herbicides were detected in any of the samples at detection limits that were well below regulatory clean-up levels.

No regulated concentrations of organic compounds or metals were detected in samples from the property. The low levels of PAHs and metals present in some of the samples are probably representative of background concentrations in dredge fill in the Duwamish industrial area.

No further sampling at the property is recommended.

WESTON performed this work and prepared this report in accordance with generally accepted professional practices, related to the nature of the work accomplished, for the exclusive use of Boeing for the specific application to the proposed SCL property. No other warranty, expressed or implied, is made.

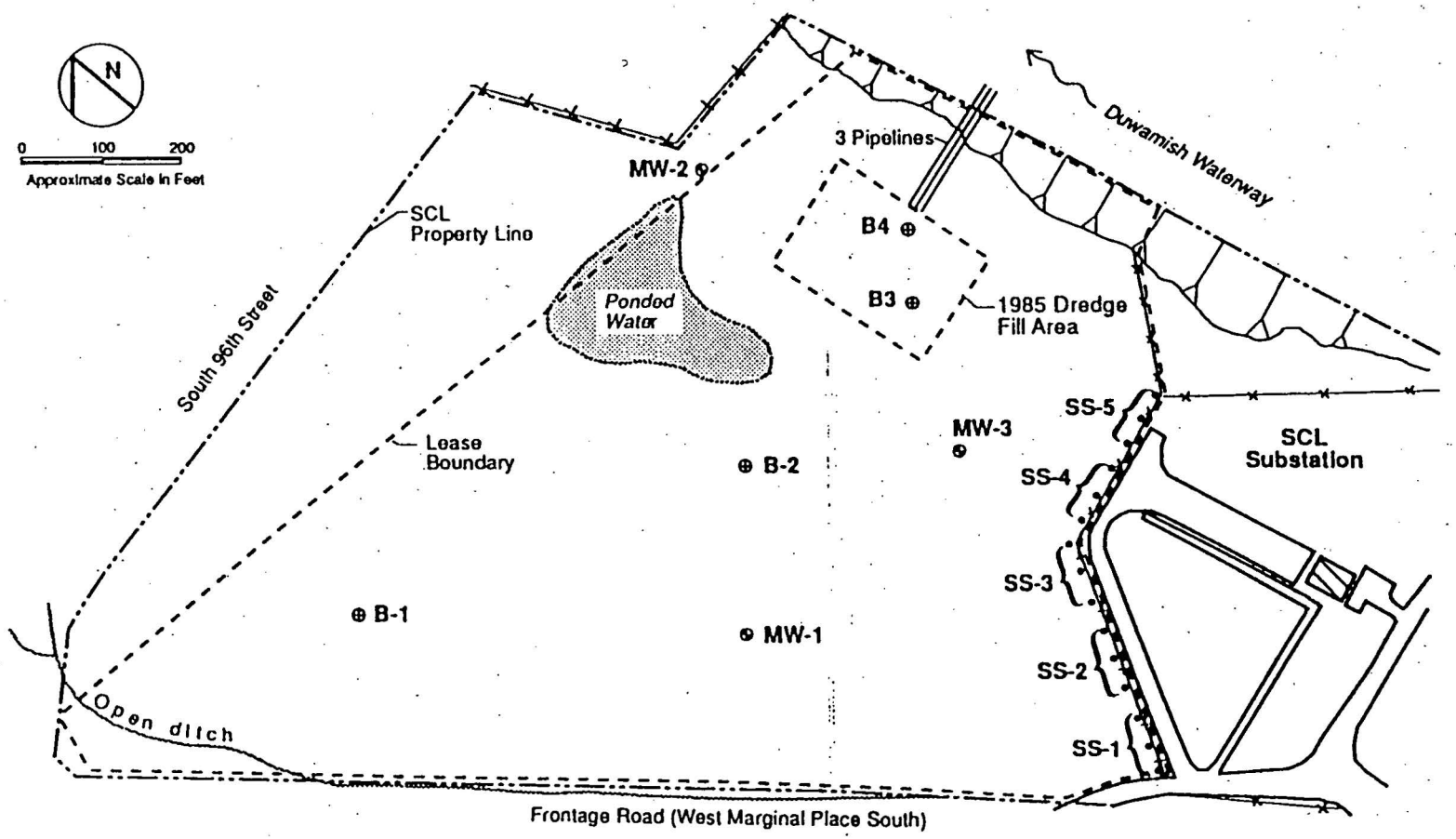
2.0 SITE ASSESSMENT

2.1 General Property Description

The property comprises approximately 20 acres of open grassy field. It is bounded to the south by SCL's Duwamish substation, to the north by the Delta Marine Industries facilities, to the east by the Duwamish Waterway, and to the west by West Marginal Place South, a frontage road of Highway 99 (Figure 2). The west and south portions of the property are crossed by several high-voltage power lines. An open ditch runs along the west boundary of the property. Photographs of the property are included in Appendix C.

The majority of the property is nearly level. A rectangular depression, approximately 200 feet on a side, is located in the east-central portion of the lease property. The depression apparently marks the area filled with dredged sediment in 1985. The depression appears to be an infilled impoundment in which dredged sediment was placed and allowed to drain.

An area of seasonally ponded water was located in the central portion of the property and noticeably decreased in size during the course of the site investigation.



Explanation

⊕	B-1	Hand Auger boring location
⊙	MW-1	Monitoring well location
•	SS-1	Surface soil sample location

Site Map and Sampling Locations

FIGURE
2

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The easternmost portion of the property along the Duwamish Water contains several exposures of milled lumber debris mixed with sandy and clayey silt fill. The lumber-containing fill appears to be a separate fill unit from the 1968 or 1985 fills, although this is uncertain because the relationship between the fill units along the waterway is obscured by vegetation and recent sedimentation. Several decayed pilings are present along the waterway shoreline.

2.2 Subsurface Stratigraphy

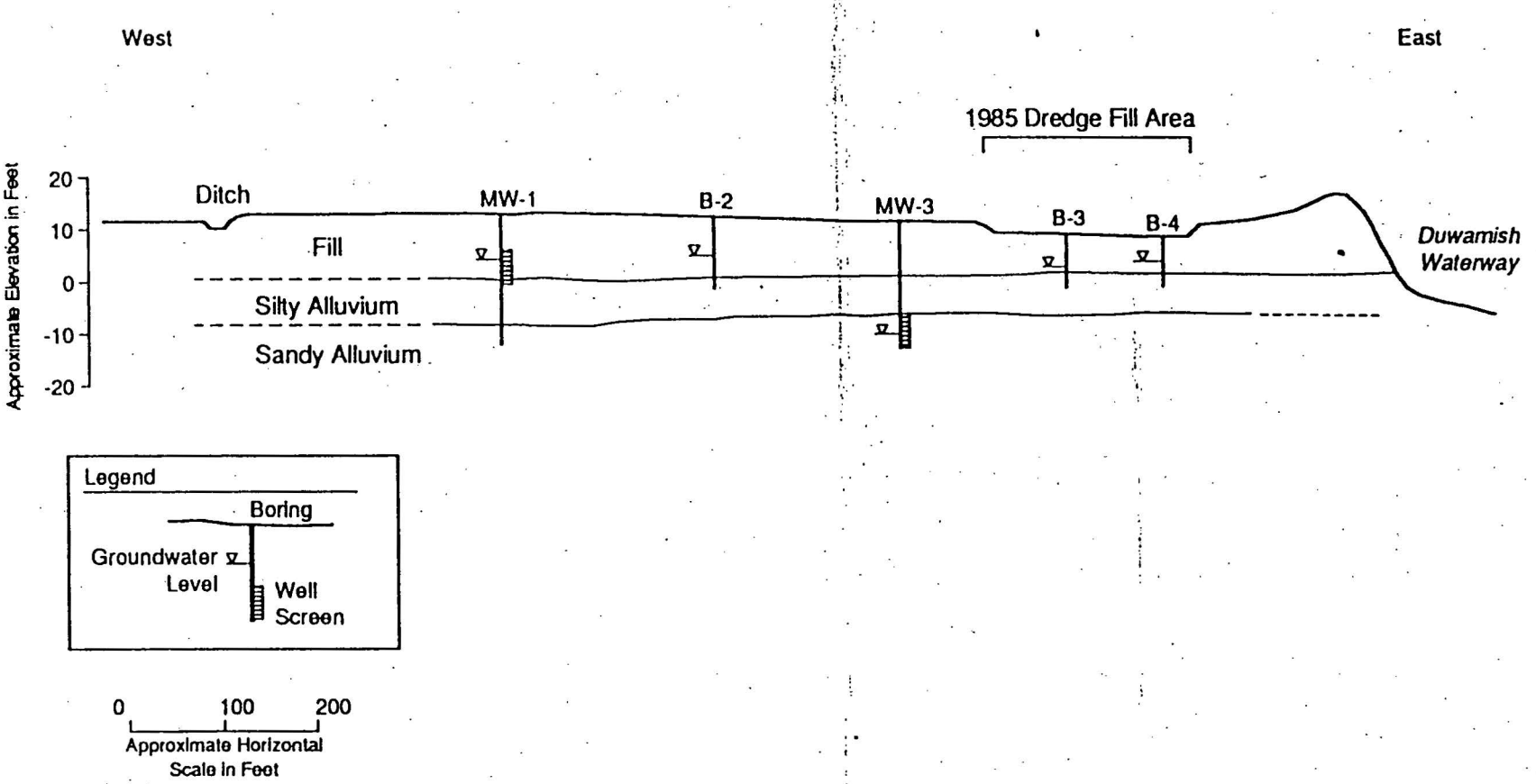
Seven soil borings were drilled on the property (Figure 2). Three of the borings, designated MW-1 through MW-3, were drilled to a depth of approximately 20 feet using a mechanical drill rig and were completed as monitoring wells on 17 April 1990. Four of the borings, designated B-1 through B-4, were drilled to depths of 6 to 10 feet using hand-auger techniques. Borings B-3 and B-4 were located in the 1985 dredge fill area. All of the other borings were completed in the 1968 dredge fill area. A discussion of drilling, sampling, and decontamination procedures used at the site are provided in Appendix A. Exploration logs of the borings are also presented in Appendix A.

The subsurface investigation indicates that the property is underlain by approximately 5 to 10 feet of stratified, heterogeneous fill that, in turn, overlies alluvium of the Duwamish River floodplain (Figure 3). Apart from the man-made levee along the present bank of the Duwamish Waterway, the fill appears to thicken progressively westward across the property. The fill is thinnest (5.5 to 6.2 feet) in the topographic depression in the east portion of the property that apparently coincides with the limits of the 1985 dredge fill.

Relatively little lithologic or textural difference was noted between the 1968 and 1985 fills. The fill is composed predominantly of crudely layered silty sand and clayey silt. The upper 1 to 4 feet of the fill is typically a loose to medium-dense, moist, brown, silty sand. Dense, black, carbonaceous, fine sand and stiff, black, clayey silt typically occur beneath the surface layer. The black sand and silt often contain abundant wood fragments. In some borings, a saturated, gray, well-graded sand layer 0 to 4 feet thick occurs at or near the base of the fill.

Fill overlying alluvium was also observed in an eroded exposure along the west bank of the Duwamish Waterway. Very abundant milled lumber debris occurs in a sandy to clayey matrix at low elevations along the bank and may be a separate fill unit from the 1968 and 1985 dredge fill units described here.

Alluvium underlying the fill consists of approximately 2 to 3 feet of gray, mottled, massive, clayey silt that often contains plant fragments. Below the mottled clayey silt is a 1.5- to 4-foot-thick unit composed of thinly bedded, gray and brown, clayey silt and fine sand. In the three deepest borings, (i.e., MW-1, MW-2, and MW-3), a



Subsurface Geologic Section
Seattle City Light Lease Option

Figure
3

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minimum of 3 to 7 feet of saturated, gray sand is present at the base of the explorations. The total thickness of this sand unit at the site is not known because it was not fully penetrated by any of the borings. The alluvium is interpreted to be fine-grained bioturbated and stratified overbank deposits and coarser channel sands of the Duwamish River.

2.3 Groundwater

Groundwater was encountered in all seven borings. A discontinuous, water-bearing zone occurred within the lower portion of the fill unit in Borings MW-1, B-1, B-2, B-3, and B-4. Depth to water varies from 3 to 6.5 feet below ground surface. This upper water-bearing zone results from the contrasting permeability of the fill sand and the underlying fine-grained unit that retards downward migration of groundwater. The water-bearing zone within the fill immediately overlies the massive, mottled, clayey silt unit of the native alluvium. Well MW-1 is screened across this water-bearing zone within the fill. Water-bearing zones within the fill were not observed in the borings for Wells MW-2 and MW-3.

A second water-bearing zone occurs within the sand unit that is located below a depth of approximately 13 feet in the sandy alluvium. This deeper water-bearing zone extends beneath the property and may be in hydraulic communication with the Duwamish Waterway. Wells MW-2 and MW-3 are both screened within this unit. Depth to water in this unit varied from 11.6 feet at Well MW-2 to 15.8 feet at Well MW-3. Groundwater flow direction in this unit could not be determined because three water level measurement points were not available. Groundwater flow at the site is most likely northeastward towards the Duwamish Waterway.

Based on the difference in water levels between Well MW-1 and Wells MW-2 and MW-3, the saturated zones within the fill and the alluvium do not appear to be connected.

2.4 Sampling Along the SCL Substation Fence Line

Five composite surface samples were collected along the north side of the fence separating the SCL substation from the lease option property. A discussion of the specific sampling and decontamination procedures used is provided in Appendix A.

The ground surface along the fence line is covered with approximately 2 to 4 inches of clean, coarse gravel. The underlying soil consisted of grayish brown, slightly silty sand fill. No staining of or odors from the soil were noted during sampling. Analytical results for the samples are presented in Section 3.

3.0 ANALYTICAL RESULTS

All samples were analyzed by Laucks Testing Laboratories, Seattle, Washington. Complete analytical results are presented in Appendix B and Tables 1 through 8. A summary of those analytes detected is presented in Table 9.

3.1 1968 Dredge Fill Area

Subsurface soil samples composited from the five borings in the 1968 dredge fill area (i.e., Borings MW-1, MW-2, MW-3, B-1, and B-2) were analyzed for PAHs and metals. The high molecular weight PAH compound benzo(a)pyrene was detected in three of the five boring samples (MW-1, MW-3, and B-1) at concentrations of 96 to 340 ug/kg. Pyrene was detected in only one boring sample (MW-3) at a concentration of 74 ug/kg. Bis(2-ethylhexyl)phthalate was detected in all five boring samples at concentrations of 87 to 490 ug/kg. No other base/neutral-extractable semivolatile compounds were detected in the composite samples from each boring.

Several metals were detected in each of the five boring samples. Metal concentrations in the samples are well within the ranges observed in natural soils by WESTON personnel in the Puget Sound region.

3.2 1985 Dredge Fill Area

Subsurface soil samples composited from the two borings in the 1985 dredge fill area (i.e., Borings B-3 and B-4) were analyzed for PCBs, semivolatile organic compounds, and metals. PCBs were not found in the samples at detection limits that range from 80 to 210 ug/kg. The PAH compounds fluoranthene (70 ug/kg), phenanthrene (53 ug/kg), pyrene (86 ug/kg), and benzo(a)pyrene (250 ug/kg) were detected in the sample from Boring B-3. Bis(2-ethylhexyl)phthalate was detected in the samples from both borings at concentrations of 440 and 380 ug/kg. No other semivolatile organic compound was detected in the sample from Boring B-4. Several metals were detected in the two boring samples. The concentration of mercury in the sample from Boring B-3 (0.51 ug/kg) appears to be slightly elevated with respect to the typical range found in natural soils of the Puget Sound region. All other metal concentrations in the two samples are well within the ranges observed in natural soils by WESTON personnel in the Puget Sound region.

3.3 Groundwater

The three groundwater samples collected from Wells MW-1, MW-2, and MW-3 on 26 April 1990 were analyzed for VOCs and selected conventional water quality parameters (i.e., alkalinity, chloride, sulfate, sodium, iron, manganese). The only VOC detected in any of the water samples was acetone, at a concentration of 8 ug/l in Well MW-1.

TABLE 1
SUBSURFACE SOIL SAMPLES – TOTAL METALS
1968 AND 1985 DREDGE FILL AREAS
SEATTLE CITY LIGHT LEASE OPTION

	Sample*						
Analyte	MW-1	MW-2	MW-3	B-1	B-2	B-3	B-4
Arsenic	4.9	4.2	7.5	5.9	4.8	8.7	5.6
Barium	50.0	76.0	67.0	56.0	42.0	74.0	50.0
Cadmium	1.0	1.3	1.3	0.9	0.5 u	1.2	0.6
Chromium	15.0	17.0	20.0	13.0	12.0	18.0	13.0
Copper	20.0	36.0	36.0	19.0	17.0	33.0	20.0
Lead	7.3	15.0	16.0	8.7	8.2	17.0	7.4
Mercury	0.1 u	0.1 u	0.24	0.1 u	0.1 u	0.51	0.1 u
Selenium	0.5 u	0.5 u	0.8	0.5	0.5 u	0.5 u	0.5 u
Silver	1.0 u	1.0 u	1.0 u	1.0 u	1.0 u	1.0 u	1.0 u
Tin	50.0 u	50.0 u	50.0 u	50.0 u	50.0 u	50.0	50.0 u

*Parts per million (mg/kg), dry basis.
u – indicates the analyte of interest was not detected, to the limit of detection shown.

TABLE 2
SUBSURFACE SOIL SAMPLES – PAHs
(Base/Neutral Fractions of Semivolatile Extractables)
1968 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION .

Analyte	Sample* MW-1	MW-2	MW-3	B-1	B-2
Aniline	200 u	210 u	230 u	220 u	210 u
Bis(2-Chloroethyl)Ether	39 u	43 u	45 u	43 u	41 u
1,3-Dichlorobenzene	39 u	43 u	45 u	43 u	41 u
1,4-Dichlorobenzene	39 u	43 u	45 u	43 u	41 u
1,2-Dichlorobenzene	39 u	43 u	45 u	43 u	41 u
Bis(2-Chloroisopropyl)Ether	39 u	43 u	45 u	43 u	41 u
N-Nitroso-Di-n-Propylamine	39 u	43 u	45 u	43 u	41 u
Hexachloroethane	79 u	86 u	90 u	87 u	83 u
Nitrobenzene	39 u	43 u	45 u	43 u	41 u
Isophorone	39 u	43 u	45 u	43 u	41 u
Bis(2-Chloroethoxy)Methane	39 u	43 u	45 u	43 u	41 u
1,2,4-Trichlorobenzene	39 u	43 u	45 u	43 u	41 u
Naphthalene	79 u	86 u	90 u	87 u	83 u
4-Chloroaniline	39 u	43 u	45 u	43 u	41 u
Hexacholrobutadiene	39 u	43 u	45 u	43 u	41 u
2-Methylnaphthalene	39 u	43 u	45 u	43 u	41 u
Hexachlorocyclopentadiene	79 u	86 u	90 u	87 u	83 u
2-Chloronaphthalene	39 u	43 u	45 u	43 u	41 u
2-Nitroaniline	79 u	86 u	90 u	87 u	83 u
Dimethyl Phthalate	39 u	43 u	45 u	43 u	41 u
Acenaphthylene	39 u	43 u	45 u	43 u	41 u
2,6-Dinitrotoluene	79 u	86 u	90 u	87 u	83 u
3-Nitroaniline	200 u	210 u	230 u	220 u	210 u
Ancaphthene	39 u	43 u	45 u	43 u	41 u
Dibenzofuran	39 u	43 u	45 u	43 u	41 u
2,4-Dinitrotoluene	79 u	86 u	90 u	87 u	83 u

*Parts per million (mg/kg), dry basis.
u – indicates the analyte of interest was not detected, to the limit of detection shown.

TABLE 2 *(Continued)*
SUBSURFACE SOIL SAMPLES – PAHs
(Base/Neutral Fractions of Semivolatile Extractables)
1968 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* MW-1	MW-2	MW-3	B-1	B-2
Diethyl Phthalate	39 u	43 u	45 u	43 u	41 u
4-Chlorophenyl-Phenylether	39 u	43 u	45 u	43 u	41 u
Fluorene	39 u	43 u	45 u	43 u	41 u
4-Nitroaniline	79 u	86 u	90 u	87 u	83 u
N-Nitrosodiphenylamine	39 u	43 u	45 u	43 u	41 u
1,2-Diphenylhydrazine	79 u	86 u	90 u	87 u	83 u
4-Bromophenyl-Phenylether	79 u	86 u	90 u	87 u	83 u
Hexachlorobenzene	39 u	43 u	45 u	43 u	41 u
Phenanthrene	39 u	43 u	45 u	43 u	41 u
Anthracene	39 u	43 u	45 u	43 u	41 u
Di-n-Butyl Phthalate	39 u	43 u	45 u	43 u	41 u
Fluoranthene	39 u	43 u	45 u	43 u	41 u
Pyrene	39 u	43 u	74	43 u	41 u
Benzidine	980 u	1100 u	1100 u	1100 u	1100 u
Butylbenzylphthalate	39 u	43 u	45 u	43 u	41 u
3,3'Dichlorobenzidine	390 u	430 u	450 u	430 u	410 u
Benzo(a)Anthracene	39 u	43 u	45 u	43 u	41 u
Chrysene	39 u	43 u	45 u	43 u	41 u
Bis(2-Ethylhexyl)Phthalate	87	160	340	390	490
Di-n-Octyl Phthalate	39 u	43 u	45 u	43 u	41 u
Benzo(b)Fluoranthene	79 u	86 u	90 u	87 u	83 u
Benzo(k)Fluoranthene	79 u	86 u	90 u	87 u	83 u
Benzo(a)Pyrene	96	86 u	340	140	83 u
Indeno(1,2,3-cd)Pyrene	79 u	86 u	90 u	87 u	83 u
Dibenzo(a,h)Anthracene	79 u	86 u	90 u	87 u	83 u
Benzo(g,h,i)Perylene	79 u	86 u	90 u	87 u	83 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 3
SUBSURFACE SOIL SAMPLES – SEMIVOLATILE ORGANIC COMPOUNDS
(Base/Neutral/Acid Fractions of Semivolatile Extractables)
1985 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* B-3	B-4
Phenol	44 u	43 u
Aniline	220 u	220 u
Bis(2-Chloroethyl)Ether	44 u	43 u
2-Chlorophenol	44 u	43 u
1,3-Dichlorobenzene	44 u	43 u
1,4-Dichlorobenzene	44 u	43 u
Benzyl Alchohol	44 u	43 u
1,2-Dichlorobenzene	44 u	43 u
2-Methylphenol	44 u	43 u
Bis(2-Chloroisopropyl)Ether	44 u	43 u
4-Methylphenol	44 u	43 u
N-Nitroso-Di-n-Propylamine	44 u	43 u
Hexachloroethane	89 u	87 u
Nitrobenzene	44 u	43 u
Isophorone	44 u	43 u
2-Nitrophenol	89 u	87 u
2,4-Dimethylphenol	44 u	43 u
Benzoic Acid	1100 u	1100 u
Bis(2-Chloroethoxy)Methane	44 u	43 u
2,4-Dichlorophenol	89 u	87 u
1,2,4-Trichlorobenzene	44 u	43 u
Naphthalene	89 u	87 u
4-Chloroaniline	44 u	43 u
Hexachlorbutadiene	44 u	43 u
4-Chloro-3-Methylphenol	89 u	87 u
2-Methylnaphthalene	44 u	43 u
Hexachlorocyclopentadiene	89 u	87 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 3 *(Continued)*
SUBSURFACE SOIL SAMPLES – SEMIVOLATILE ORGANIC COMPOUNDS
(Base/Neutral/Acid Fractions of Semivolatile Extractables)
1985 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* B-3	B-4
2,4,6-Trichlorophenol	89 u	87 u
2,4,5-Trichlorophenol	89 u	87 u
2-Chloronaphthalene	44 u	43 u
2-Nitroaniline	89 u	87 u
Dimethyl Phthalate	44 u	43 u
Acenaphthylene	44 u	43 u
2,6-Dinitrotoluene	89 u	87 u
3-Nitroaniline	220 u	220 u
Acenaphthene	44 u	43 u
2,4-Dinitrophenol	440 u	430 u
4-Nitrophenol	440 u	430 u
Dibenzofuran	44 u	43 u
2,4-Dinitrotoluene	89 u	87 u
Diethyl Phthalate	44 u	43 u
4-Chlorophenyl-Phenylether	44 u	43 u
Fluorene	44 u	43 u
4-Nitroaniline	89 u	87 u
4,6-Dinitro-2-Methylphenol	440 u	430 u
N-Nitrosodiphenylamine	44 u	43 u
1,2-Diphenylhydrazine	89 u	87 u
4-Bromophenyl-Phenylether	89 u	87 u
Hexachlorobenzene	44 u	43 u
Pentachlorophenol	440 u	430 u
Phenanthrene	53	43 u
Anthracene	44 u	43 u
Di-n-Butyl Phthalate	44 u	43 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 3 *(Continued)*
SUBSURFACE SOIL SAMPLES – SEMIVOLATILE ORGANIC COMPOUNDS
(Base/Neutral/Acid Fractions of Semivolatile Extractables)
1985 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* B-3	B-4
Fluoranthene	70	43 u
Pyrene	86	743 u
Benzidine	1100 u	1100 u
Butylbenzylphthalate	44 u	43 u
3,3'Dichlorobenzidine	440 u	430 u
Benzo(a)Anthracene	44 u	43 u
Chrysene	44 u	43 u
Bis(2-Ethylhexyl)Phthalate	440	380
Di-n-Octyl Phthalate	44 u	43 u
Benzo(b)Fluoranthene	89 u	87 u
Benzo(k)Fluoranthene	89 u	87 u
Benzo(a)Pyrene	250	87 u
Indeno(1,2,3-cd)Pyrene	89 u	87 u
Dibenzo(a,h)Anthracene	89 u	87 u
Benzo(g,h,i)Perylene	89 u	87 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 4
SURFACE SOIL SAMPLES – PESTICIDES AND PCBs
1985 DREDGE FILL AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* B-3	B-4
alpha-BHC	11.0 u	10.0 u
beta-BHC	11.0 u	10.0 u
delta-BHC	11.0 u	10.0 u
gamma-BHC (lindane)	11.0 u	10.0 u
Heptachlor	11.0 u	10.0 u
Aldrin	11.0 u	10.0 u
Heptachlor epoxide	11.0 u	10.0 u
Endosulfan I	11.0 u	10.0 u
Dieldrin	21.0 u	21.0 u
4,4'-DDE	21.0 u	21.0 u
Endrin	21.0 u	21.0 u
Endosulfan II	21.0 u	21.0 u
4,4'-DDD	21.0 u	21.0 u
Endosulfan sulfate	21.0 u	21.0 u
4,4'-DDT	21.0 u	21.0 u
Methoxychlor	110.0 u	100.0 u
Endrin ketone	21.0 u	21.0 u
alpha-Chlordane	110.0 u	100.0 u
gamma-Chlordane	110.0 u	100.0 u
Toxaphene	210.0 u	210.0 u
Arochlor-1016	110.0 u	100.0 u
Arochlor-1221	110.0 u	100.0 u
Arochlor-1232	110.0 u	100.0 u
Arochlor-1242	110.0 u	100.0 u
Arochlor-1248	110.0 u	100.0 u
Arochlor-1254	210.0 u	210.0 u
Arochlor-1260	210.0 uu	210.0 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 5
GROUNDWATER SAMPLES – VOLATILE ORGANIC COMPOUNDS
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* MW-1	MW-2	MW-3
Chloromethane	1 u	1 u	1 u
Bromomethane	1 u	1 u	1 u
Vinyl Chloride	1 u	1 u	1 u
Chloroethane	3 u	3 u	3 u
Methylene Chloride	1 u	1 u	1 u
Acetone	8	5 u	5 u
Carbon Disulfide	1 u	1 u	1 u
1,1-Dichloroethene	1 u	1 u	1 u
1,1-Dichloroethane	1 u	1 u	1 u
Trans-1,2-Dichloroethene	1 u	1 u	1 u
Cis-1,2-Dichloroethene	1 u	1 u	1 u
Total 1,2-Dichloroethene	1 u	1 u	1 u
Chloroform	1 u	1 u	1 u
2-Butanone	3 u	3 u	3 u
1,2-Dichloroethane	1 u	1 u	1 u
1,1,1-Trichloroethane	1 u	1 u	1 u
Carbon Tetrachloride	1 u	1 u	1 u
Vinyl Acetate	1 u	1 u	1 u
Bromodichloromethane	1 u	1 u	1 u
1,2-Dichloropropane	1 u	1 u	1 u
Trichloroethene	1 u	1 u	1 u
Benzene	1 u	1 u	1 u
Dibromochloromethane	3 u	3 u	3 u
1,1,2-Trichloroethane	1 u	1 u	1 u
Bromoform	1 u	1 u	1 u
4-Methyl-2-Pentanone	3 u	3 u	3 u
2-Hexanone	3 u	3 u	3 u
1,1,2,2-Tetrachloroethane	3 u	3 u	3 u
Tetrachloroethene	1 u	1 u	1 u
Toluene	1 u	1 u	1 u
Chlorobenzene	3 u	3 u	3 u
Trans-1,3-Dichloropropene	3 u	3 u	3 u
Ethylbenzene	1 u	1 u	1 u
Cis-1,3-Dichloropropene	3 u	3 u	3 u
Stryrene	1 u	1 u	1 u
Total Xylene	1 u	1 u	1 u

* Results in ug/L
u – indicates the analyte of interest was not detected, to the limit of detection shown.

TABLE 6
GROUNDWATER SAMPLES – CONVENTIONAL PARAMETERS
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample*		
	MW-1	MW-2	MW-3
Chloride	150.0	1400.0	19.0
Iron	4.8	30.0	6.0
Managanese	0.30	3.8	0.23
Sodium	440.0	1300.0	210.0
Sulfate as SO4	43.0	3.0	15.0
Total Alkalinity as CaCO3	690.0	1100.0	310.0

* Results in mg/L

TABLE 7
SURFACE SOIL SAMPLES – PESTICIDES AND PCBs
SUBSTATION FENCE LINE AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* SS-1	SS-2	SS-3	SS-4	SS-5
alpha-BHC	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
beta-BHC	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
delta-BHC	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
gamma-BHC (lindane)	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
Heptachlor	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
Aldrin	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
Heptachlor epoxide	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
Endosulfan I	8.7 u	8.7 u	8.8 u	8.6 u	8.6 u
Dieldrin	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
4,4'-DDE	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
Endrin	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
Endosulfan II	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
4,4'-DDD	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
Endosulfan sulfate	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
4,4'-DDT	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
Methoxychlor	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Endrin ketone	17.0 u	17.0 u	18.0 u	17.0 u	17.0 u
alpha-Chlordane	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
gamma-Chlordane	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Toxaphene	170.0 u	170.0 u	180.0 u	170.0 u	170.0 u
Arochlor-1016	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Arochlor-1221	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Arochlor-1232	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Arochlor-1242	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Arochlor-1248	87.0 u	87.0 u	88.0 u	86.0 u	86.0 u
Arochlor-1254	170.0 u	170.0 u	180.0 u	170.0 u	170.0 u
Arochlor-1260	170.0 u	170.0 u	180.0 u	170.0 u	170.0 u

*Parts per billion (ug/kg), dry basis.
u – Analyte of interest was not detected, to the limit of detection shown.

TABLE 8
SURFACE SOIL SAMPLES – CHLORINATED HERBICIDES
SUBSTATION FENCE LINE AREA
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Sample* SS–1	SS–2	SS–3	SS–4	SS–5
2,4–D	11.0 u	11.0 u	11.0 u	11.0 u	11.0 u
2,4,5–T	5.4 u	5.5 u	5.5 u	5.5 u	5.4 u
2,4,5–TP	5.4 u	5.5 u	5.5 u	5.5 u	5.4 u

* Parts per billion (ug/kg), dry basis.
u – indicates the analyte of interest was not detected, to the limit of detection shown.

TABLE

SUMMARY OF ANALYTES DETECTED
SEATTLE CITY LIGHT LEASE OPTION

Analyte	Units	Soil												Water		
		MW-1	MW-2	MW-3	B-1	B-2	B-3	B-4	SS-1	SS-2	SS-3	SS-4	SS-5	MW-1	MW-2	MW-3
Volatile Organic Compounds																
Acetone	ug/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8	5u	5u
Semivolatile Compounds																
Fluoranthene	ug/kg	39u	43u	45u	43u	41u	70	43u	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	ug/kg	39u	43u	45u	43u	41u	53	43u	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	ug/kg	87	160	340	390	490	440	380	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	ug/kg	39u	43u	74	43u	41u	86	43u	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	ug/kg	96	86u	340	140	83u	250	87u	NA	NA	NA	NA	NA	NA	NA	NA
Metals																
Arsenic	mg/kg	4.9	4.2	7.5	5.9	4.8	8.7	5.6	NA	NA	NA	NA	NA	NA	NA	NA
Barium	mg/kg	50	76	67	56	42	74	50	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	mg/kg	1.0	1.3	1.3	0.9	0.5u	1.2	0.6	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/kg	15	17	20	13	12	18	13	NA	NA	NA	NA	NA	NA	NA	NA
Copper	mg/kg	20	36	36	19	17	33	20	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/kg	7.3	15	16	8.7	8.2	17	7.4	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/kg	0.1u	0.1u	0.24	0.1u	0.1u	0.51	0.1u	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/kg	0.5u	0.5u	0.8	0.5	0.5u	0.5	0.5u	NA	NA	NA	NA	NA	NA	NA	NA
Conventional Paramenters																
Chloride	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	150	1400	1
Sulfate	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	43	3	1
Alkalinity	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	690	1100	31
Iron	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8	30	6.
Manganese	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.30	3.8	0.2
Sodium	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	440	1300	21

NA – Sample not analyzed for this analyte
u – Compound was not detected; associated value is the sample detection limit.

All of the conventional water quality parameters were detected at low to moderate concentrations. Chloride concentrations were highest at Well MW-2 (1400 mg/l) indicating brackish conditions in the native sand aquifer at that location and some influence from the saltwater wedge in the adjacent Duwamish Waterway. Iron, manganese, sodium, and total alkalinity are also highest at Well MW-2. Field measurements indicate the groundwater has a pH of 7.0 to 7.1.

3.4 SCL Substation Fence Line Area

The five surface soil samples collected along the SCL substation fence line were analyzed for pesticides, PCBs, and three chlorinated herbicides. The five samples did not contain detectable concentrations of any of these compounds at detection limits of 8.6 to 180 ug/kg for pesticides, 86 to 170 ug/kg for PCBs, and 5.4 to 11.0 ug/kg for herbicides.

4.0 DISCUSSION

4.1 1968 Dredge Fill Area

The 1968 dredge fill contained low concentrations of PAHs and metals. Total PAHs concentrations (140 to 414 ug/kg) in composite samples from the fill were below the draft soil clean-up levels for total carcinogenic PAHs specified in the Washington State Model Toxics Control Act (MTCA) Cleanup Regulations (1.0 mg/kg) (9 March 1990). These PAH concentrations are probably representative of background PAH concentrations of dredge fill in the Duwamish industrial area.

Total metals concentrations in the 1968 fill samples are well below draft MTCA soil clean-up levels and are at concentrations so low they will not fail EP toxicity criteria.

4.2 1985 Dredge Fill Area

The 1985 dredge fill also contained low concentrations of PAHs and metals. PCBs were not detected in either composite fill sample at detection limits that are well below the most stringent PCB clean-up standards. Several PAHs were detected in the composite soil sample from Boring B-3 at a total concentration of 549 ug/kg. Again, this concentration is below the draft MTCA clean-up standard for PAHs in soil.

Total metals concentrations in the 1985 fill samples were well below MTCA clean-up levels. Although the concentration of mercury (0.51 mg/kg) in the composite sample from Boring B-3 is slightly elevated above the typical range for natural

soils, it is still below the draft MTCA clean-up level for mercury in soil (1.0 mg/kg).

4.3 Groundwater

No volatile organic compounds were detected in groundwater at the site, except acetone, at a very low concentration (8 ug/l) in the sample from Well MW-1. Acetone is a common laboratory contaminant and its presence in sample MW-1 may be a laboratory artifact, although it was not found in the associated laboratory blank.

Chloride, iron, and manganese concentrations (1,400 mg/L, 30 mg/L, 3.8 mg/L, respectively) at Well MW-2 exceed Washington secondary maximum contaminant levels (SMCLS) for these constituents (SMCLS: chloride = 250 mg/l; iron = 0.3 mg/l; manganese = 0.05 mg/l). The SMCLS for iron and manganese are also exceeded by samples from Wells MW-1 and MW-3.

4.4 SCL Substation Fence Line Area

PCBs, pesticides, and herbicides were not detected in composite surface soil samples collected from beneath decorative gravel along the substation fence line. The detection limits reported for these compounds are well below their respective regulatory clean-up levels. The fresh appearance of the decorative gravel along the fence line and the uniform nature of the sandy soil beneath suggests that they have been placed within the last few years.

5.0 RECOMMENDATIONS

Based on the results of the baseline soil and groundwater quality assessment, no further sampling at the SCL long-term lease option property is recommended.

Boeing should maintain a copy of this baseline report in appropriate files so that it is available for reference at the time of the lease termination.

Because 2-inch-diameter PVC monitoring wells are not anticipated to remain functional for the entire 50-year term of the lease, and because the risk of well damage during building construction is relatively high even with traffic protection posts in place, the three monitoring wells installed on the property should be abandoned in accordance with Chapter 173-160 of the Washington Administrative Code prior to the initiation of construction activities.

If the monitoring wells are left in place, any further groundwater sampling or well redevelopment should be conducted by qualified personnel.